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Asthenognathus laverdensis n. sp.
(Decapoda: Brachyura: Pinnotheridae)
from the lower Oligocene of Laverda (Vicenza, NE Italy)

Abstract - Specimens of decapod crustaceans discovered in the marls from the lower Oligocene of Laverda (Vicenza, NE Italy) document a new species *Asthenognathus laverdensis* (infraorder Brachyura Latreille, 1802, superfamily Pinnotheroidea De Haan, 1833, family Pinnotheridae De Haan, 1833). This genus currently includes three Recent species, widespread in the eastern Atlantic and Indo-Pacific, and four fossil species from the middle-upper Oligocene and Miocene of the United States, Argentina, and Japan. *Asthenognathus laverdensis* n. sp. represents the geologically oldest species known to date and the first report of this genus in Europe.

Key words: Crustacea, Decapoda, Pinnotheridae, lower Oligocene, Italy.

Riassunto - *Asthenognathus laverdensis* n. sp. (Decapoda: Brachyura: Pinnotheridae) dell'Oligocene inferiore di Laverda (Vicenza, NE Italia).

Alcuni esemplari di crostacei decapodi scoperti nelle marne dell'Oligocene inferiore di Laverda (Vicenza, NE Italia) appartengono alla nuova specie *Asthenognathus laverdensis* (infraordine Brachyura Latreille, 1802, superfamiglia Pinnotheroidea De Haan, 1833, famiglia Pinnotheridae De Haan, 1833). Questo genere comprende tre specie viventi, distribuite nell'Atlantico orientale e nell'Indo-Pacifico e quattro specie fossili dell'Oligocene medio e superiore e Miocene degli Stati Uniti, Argentina e Giappone. *Asthenognathus laverdensis* n. sp. rappresenta geologicamente la specie più antica e la prima segnalazione di questo genere in Europa.

Parole chiave: Crustacea, Decapoda, Pinnotheridae, Oligocene inferiore, Italia.

Introduction and geological setting

The piedmont area between the Vicenza Lessini and Marosticano is rich in Oligocene deposits of lagoonal and brackish origin, often crossed by or intercalated with volcanoclastic materials. These deposits, sometimes fossiliferous and well exposed in the Laverda Valley (Fig. 1), have been the subject of stratigraphic and palaeontologic studies by many authors (Fabiani, 1912a, 1912b, 1915; Piccoli,

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1967; Mandruzzato, 1970; Pfister, 1980; Trevisani, 1994; Mietto, 1997). The lower Oligocene, in Laverda Valley, is composed of marly limestones with corals, bryozoans and nummulites (*N. intermedia*), arenaceous limestones with echinoderms, and a sequence of rough sandstones and conglomerates with quartz and jasper pebbles, often rich in molluscs (Formazione di Calvene). At the top, a sequence of sandstones and marly limestones with nummulites (*N. vasca*), corals, bryozoans, and decapod crustaceans, *Coeloma vigil* A. Milne Edwards, 1860, and *Portunus suessi* (Bittner, 1875) is exposed. Bittner (1875) also described *Palaeograpsus inflatus* from Laverda without giving any stratigraphic indication; probably this species was discovered in the middle Eocene levels including *Harpactocarcinus punctulatus* (Desmarest, 1822).

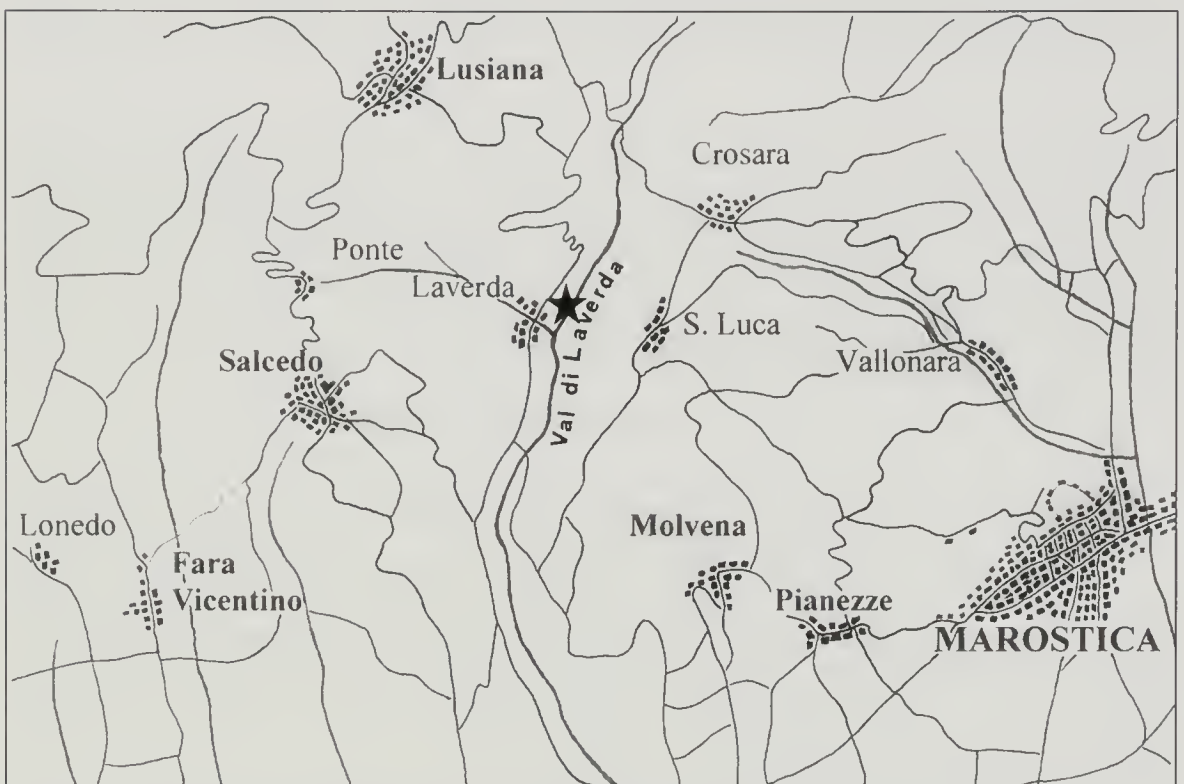


Fig. 1 - Geographic map of the studied area with the fossiliferous site (asterisk). Carta geografica dell'area studiata con la località fossilifera segnalata dall'asterisco.

The Oligocene marls of Laverda are well exposed close to the village, along the right margin of Laverda River. The specimens of *Astenognathus*, subject of this paper, were discovered in these levels.

An outcrop exposing freshwater and brackish sediments, crops out in Ponte Valley, the right tributary of Laverda River. The layers, composed of lignite and black shale, are rich of plants, gastropods, decapod crustaceans (*Penaeus vanzii* Beschin & Garassino, 1999), fishes, and amphibians (*Palaeobatrachus vicetinus* Peters, 1877), described by Peters (1877) and Portis (1885).

Finally, clay shale crops out among the volcanic rocks of Salcedo (Formazione di Salcedo). Fishes, amphibians, reptiles, and plants are preserved in these levels. Many decapod crustaceans were also described, *Portunus arcuatus* (A. Milne

Edwards, 1860), *P. incertus* (A. Milne Edwards, 1860), *P. cfr. P. radobojanus* (Bittner, 1884), *P. cfr. P. stenaspis* (Bittner, 1884), *P. (Achelous) obtusus* (A. Milne Edwards, 1860), *Charybdis antiqua* (A. Milne Edwards, 1860), *Scylla* sp., and *Penaeus sorbinii* Beschin & Garassino, 1999 (A. Milne Edwards, 1860; Ristori, 1892; Beschin & Garassino, 1999). Recently, samples of amber were discovered in these levels (Ragazzi & Roghi, 2003).

Material

The studied specimens (15 in all) from the lower Oligocene of Laverda are housed in the Museo Civico di Storia Naturale di Milano (9 specimens) and in the Museo Civico "G. Zannato" di Montecchio Maggiore (Vicenza) (6 specimens). The specimens are preserved three-dimensionally and their preparation was easy as a result of the softness of the surrounding rock. The sizes of the specimens are expressed in millimetres.

The systematic arrangement used in this paper follows the recent classification proposed by Martin & Davis (2001).

Acronyms. MSNM: Museo Civico di Storia Naturale, Milano; MCZ: Museo Civico "G. Zannato" di Montecchio Maggiore (Vicenza).

Systematic Palaeontology

Infraorder Brachyura Latreille, 1802
Section Eubrachyura De Saint Laurent, 1980
Subsection Thoracotremata Guinot, 1977
Superfamily Pinnotheroidea De Haan, 1833
Family Pinnotheridae De Haan, 1833
Subfamily Asthenognathinae Stimpson, 1858
Genus *Asthenognathus* Stimpson, 1858

Type species: *Asthenognathus inaequipes* Stimpson, 1858, by original designation.

Asthenognathus laverdensis n. sp.

Figs. 2, 3, 4

Diagnosis: carapace trapezoid, wider than long, convex in longitudinal section; front restricted distally, bilobate and grooved medially; orbits suboval; anterolateral and posterolateral margins converging; posterolateral reentrants well developed; posterior margin elongate and weakly convex; dorsal surface smooth; cervical and branchiocardiac grooves engraved medially.

Etymology: from Laverda where the studied specimens were discovered.

Holotype: MSNM i26744.

Paratypes: MSNM i26745, i26746, i26747, i26748, i26749, i26750, i26751, i26752; MCZ 2467, 2468, 2469, 2470, 2471, 2472.

Type locality: Laverda (Vicenza).

Stratigraphic range: lower Oligocene.

Occurrence and measurements: fifteen specimens well preserved. The specimen MSNM i26745 preserves the abdominal parts. The specimens MCZ 2467, 2469, 2470, 2471, 2472 are slightly deformed.

MSNM i26744 – width: 10.5; length: 7.5

MSNM i26746 – width: 9.6

MSNM i26747 – width: 9.8; length: 7

MSNM i26748 – width: 10.7; length: 8.5

MSNM i26749 – width: 8.8; length: 7

MSNM i26750 – width: 10.3; length: 8.7

MSNM i26751 – width: 9; length: 7.2

MSNM i26752 – width: 9.2; length: 6.9

MCZ 2468 – width: 9.8; length: 7.8

Description. Carapace trapezoid, wider than long, convex in longitudinal section. Fronto-orbital margin (MSNM i26750, i26751) comparatively wide. Front bilobate, weakly deflected, with margin restricted distally and engraved by median longitudinal groove. Orbits small and suboval. Supraorbital margins without fissures or extraorbital teeth. Anterolateral and posterolateral margins converging. Anterolateral margins strongly diverging, convex and weakly carinate in lateral view. Posterolateral reentrants well developed with margin slightly concave marked by a weak carina. Posterior margin comparatively wide and slightly concave in median part. Regions well marked. Frontal region with longitudinal groove. Metagastric region well marked posteriorly by a deep convex groove. Branchiocardiac grooves well developed along margins of cardiac region. Dorsal surface smooth with weak and irregular granulations on posterior branchial regions. Chelipeds of equal sizes. Sternum and male abdomen partially preserved in one specimen (MSNM i26745).

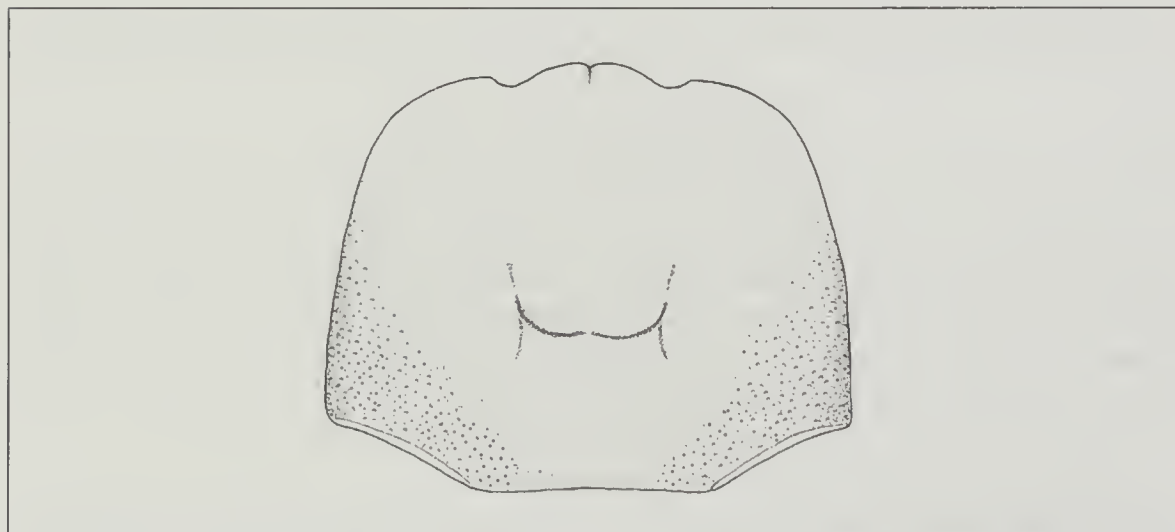


Fig. 2 – *Asthenognathus laverdensis* n. sp., reconstruction of the carapace (ricostruzione del carapace).

Discussion. The diagnostic characters of the subfamily Asthenognathinae Stimpson, 1858, with *Asthenognathus* Stimpson, 1858, were recently discussed by Schweitzer & Feldmann (2001), and Casadío *et al.* (2004). This genus contains three Recent species: *A. inaequipes* Stimpson, 1858, and *A. atlanticus* Monod, 1933, widespread along the Atlantic coasts of France and North Africa (Monod, 1956; Manning & Holthuis, 1981), and *A. hexagonum* Rathbun, 1909, widespread in the Indo-Pacific area (Rathbun, 1909; Sakai, 1976). Four fossil species are known to date: *A. cornishorum* Schweitzer & Feldmann, 1999 (lower Miocene – United States), *A. globosa* (Karasawa, 1990) (= *Tritodynamia*) (lower-middle Miocene – Japan), *A. microspinus* Casadío, De Angeli, Feldmann, Garassino, Hetler, Parras & Schweitzer, 2004 (middle Oligocene – Argentina), and *A. urretae* Schweitzer & Feldmann, 2001 (upper Oligocene – Argentina).

Asthenognathus cornishorum Schweitzer & Feldmann, 1999, differs from the new species because the carapace of *A. cornishorum* is narrower anterior, with wider orbits, weakly marked protogastric regions, and groove marking posterior of the metagastric region located anteriorly with respect to the median length of the carapace.

Asthenognathus globosa (Karasawa, 1990) differs from the new species because the anterior part of the carapace of *A. globosa* is narrower, groove marking the posterior of the metagastric region is located more anteriorly with respect to the median length of the carapace, and the dorsal ornamentation exhibits strong granulations.

Asthenognathus microspinus Casadío, De Angeli, Feldmann, Garassino, Hetler, Parras & Schweitzer, 2004, differs from the new species because the carapace of *A. microspinus* has lateral margins that are more parallel having small marginal spines, and possesses a dorsal surface with small granulations.

Even though *A. urretae* Schweitzer & Feldmann, 2001, has a carapace shape very similar to that of *A. laverdensis* n. sp., it differs because the groove marking the posterior of the metagastric region is located at midlength of the carapace and the branchial and hepatic regions bear small granulations.

Asthenognathus laverdensis n. sp. has some morphological affinities with *Tetrias?* sp. from the Langhian of Catalonia (Spain), described and figured by Müller (1993, p. 24, fig. 11C). In fact, the Spanish species has a carapace with the typical trapezoid shape, posterolateral reentrants well developed, weakly protruding front, narrow orbits, and a dorsal surface with the metagastric region well marked posteriorly by a deep curved groove. *Tetrias?* sp. could be included in *Asthenognathus*, representing a second fossil species for the European Mediterranean Basin. Despite the morphological affinities between the two species, *Tetrias?* sp. differs from *A. laverdensis* n. sp. in having a more rectangular shape of the carapace, and possessing small granulations on branchial and posterior regions.

Asthenognathus laverdensis n. sp. represents the first report of this genus in Europe and the oldest fossil species known to date, because the other fossil species are from the middle-upper Oligocene and Miocene. This species lived in a shallow, sandy lagoonal environment, rich in organic debris. It is associated with other brachyurans, including *Coeloma vigil* A. Milne Edwards, 1865, and *Portunus suessi* (Bittner, 1875) very abundant and well preserved in the marly limestones of Laverda Valley.

The known fossils of *Asthenognathus* suggest a wide tropical distribution along the Tethyan seaway. In fact, the Recent species attest a continuity of a tropical distribution originated from Tethyan relicts (Casadío *et al.*, 2004).



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Fig. 3 - 1) *Asthenognathus laverdensis* n. sp., holotype, n. cat. MSNM i26744 (x 4); 2) *Asthenognathus laverdensis* n. sp., n. cat. MSNM i26750 (x 3); 3) *Asthenognathus laverdensis* n. sp., n. cat. MSNM i26745 (x 4); 4) *Asthenognathus laverdensis* n. sp., n. cat. MSNM i26746 (x 4).



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Fig. 4 - 1) *Asthenognathus laverdensis* n. sp., n. cat. MCZ 2467 (x 3); 2) *Asthenognathus laverdensis* n. sp., n. cat. MSNM i26747 (x 3); 3) *Asthenognathus laverdensis* n. sp., n. cat. MSNM i26749 (x 4).

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